NOTICE OF PREPARATION

TO: DISTRIBUTION

DATE: January 7, 2011

SUBJECT: **Notice of Preparation of a Draft Programmatic Environmental Impact Report**

LEAD AGENCY: State Coastal Conservancy

PROJECT NAME: Humboldt Bay Regional Invasive Spartina Control and Native Salt Marsh Restoration

PROJECT AREA: Humboldt Bay, Eel River Delta, and Mad River Estuary in Humboldt County, CA

The State Coastal Conservancy will prepare a Programmatic Environmental Impact Report for the Humboldt Bay Regional Invasive Spartina Control and Native Salt Marsh Restoration Project. We need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use this EIR when considering your permit or other approval for the project. The project description, location, and environmental issues are contained in the attached **Notice of Preparation.**

Due to the time limits mandated by State law, your response must be received at the earliest possible date but not later than 30 days after receipt of this notice. A public scoping hearing will be held on January 19, 2010 at 7:00 p.m. Location : Arcata D Street Neighborhood Center, located on D Street between 13th and 14th St in Arcata.

Please send your written response, including the name of a contact person with your agency, to **California State Coastal Conservancy, attention Joel Gerwein** at the address below.
1330 Broadway, 13th floor
Oakland, CA 94612
e-mail: jgerwein@scc.ca.gov

DATE ISSUED: January 7, 2011

NOTICE OF PREPARATION OF A DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT REPORT

The State Coastal Conservancy (Conservancy) will prepare a Programmatic Environmental Impact Report (EIR) in compliance with the California Environmental Quality Act (CEQA) for the Humboldt Bay Regional Invasive Spartina Control and Native Salt Marsh Restoration Project (Project). The accompanying Notice of Preparation (NOP) has been prepared to satisfy the requirements of CEQA. This EIR will evaluate the environmental effects of adoption and implementation of a regional program for the control of non-native *Spartina* in Humboldt Bay, the Eel River Delta, and the Mad River Estuary. The goal of the Project is to control dense-flowered cordgrass (*S. densiflora*) and restore tidal marshlands in the project area, which provide habitat for a diverse community of plants and wildlife, including several special status species. It is estimated that the control of *S. densiflora* could enhance 2,000 acres of tidal wetland. In addition to its impacts locally to these estuaries, *Spartina* in Humboldt Bay and adjacent estuaries threatens to colonize other west coast estuaries via ocean dispersal of its seeds, as

demonstrated by the preliminary results of a drift card study carried out by Portland State University. Drift cards from Humboldt Bay in 2004 and 2005 were found within a month of their release in numerous locations along the Oregon Coast, as well as in southwest Washington. The 2007 West Coast Governors' Agreement on Ocean Health Action Plan calls for the west coast-wide eradication of invasive Spartina by the year 2018.

The proposed regional program for the control of non-native *Spartina* in Humboldt Bay may utilize one or more of the following treatment and control methodologies: mechanical removal; manual removal; mowing; covering/blanketing; flooding; flaming of seedlings or application of herbicide. Environmental impacts of the proposed control methods would be evaluated throughout the project area. Project specific impact evaluation would be conducted at up to four pilot project sites yet to be determined.

The Conservancy is the lead agency under CEQA. The project will be conducted in close coordination with the Humboldt Bay Harbor, Recreation and Conservation District, the California Department of Fish and Game (CDFG), the US Fish and Wildlife Service (USFWS), the Cities of Arcata and Eureka, the County of Humboldt, other local agencies, the Wiyot Tribe, and landowners with populations of invasive *Spartina*. The NOP is an important step in the environmental scoping process, which is designed to determine the range of the issues to be addressed in the EIR. The objectives of scoping include:

- Ensuring agency and public involvement in the environmental review process,
- Determining which specific impacts must be evaluated in the EIR,
- Establishing a reasonable range of alternatives, and
- Identifying the scope of issues that must be discussed, in order to adequately and accurately address the potential impacts of the project as they relate to permitting and approval authority.

The Conservancy requests your comments on the scope and content of the Draft EIR. Pursuant to CEQA Section 21080.4(a) responsible and trustee agencies are asked to provide in writing the scope and content of the environmental information that is germane to their statutory responsibilities, as these agencies will need to use the EIR prepared by the Conservancy when considering permits or other approvals for the project. Responsible and trustee agencies are also requested to provide a list of the permits and/or other approvals that must be obtained in order to implement the project.

A Notice of Preparation, prepared pursuant to CEQA Section 21080.6, is attached and includes: 1) a description of the proposed action and alternatives and the basis for selecting the alternatives, 2) a list of the potentially significant effects on the environment of the project, and 3) the scope of, and analyses and methodology for, EIR preparation. As indicated in the NOP, the major environmental issues to be addressed include water quality, biological resources, and hazards/hazardous materials.

For additional information about the project or the scoping process, please contact:

Joel Gerwein
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612
Phone: 510-286-4170
Fax: 510-286-0470
Email: jgerwein@scc.ca.gov

Written comments on the scope and content of the EIR should be directed to Joel Gerwein and must be received at the above address no later than X, 2011. A formal scoping hearing, designed to solicit public comment on the proposed action and alternatives, has also been scheduled for **January 19, 2011 at 7:00 p.m.**
Location : D Street Neighborhood Center, located on D Street between 13th and 14th St in Arcata, CA.

ATTACHMENT: Notice of Preparation

NOP DISTRIBUTION:

This Notice of Preparation was sent to the following agencies, organizations, firms, and individuals:

Federal
US Fish and Wildlife Service Humboldt Bay National Wildlife Refuge
US Fish and Wildlife Service Arcata Fish and Wildlife Office
National Marine Fisheries Service
National Park Service: Redwood National and State Park
US Coast Guard Humboldt Bay Station
US Army Corps of Engineers
Natural Resources Conservation Service
Bureau of Land Management

Tribal
Wiyot Tribe
Bear River Band of Rohnerville Rancheria
Blue Lake Rancheria

State
California Coastal Commission
Department of Transportation
Department of Fish and Game
Department of Food and Agriculture
Department of Public Health
State Lands Commission
North Coast Regional Water Quality Control Board
North Coast Unified Air Quality Management District
California Conservation Corps
California Sea Grant- Eureka Office
University of California Cooperative Extension- Eureka Office

County
County of Humboldt Community Development Department
County of Humboldt Agricultural Commissioner
County of Humboldt Parks Department

Cities Local/Special Districts
Humboldt Bay Harbor, Recreation and Conservation District
Humboldt County Resource Conservation District

Humboldt County Weed Management Area
Humboldt Bay Municipal Water District
Humboldt Community Services District
Manila Community Services District
North Coast Railroad Authority
South Bay Union School District
Jacoby Creek Elementary School District
Arcata Elementary School District
Pacific Union Elementary School District
Freshwater Elementary School District
Humboldt County Office of Education
School District
Eureka City Unified School District
Peninsula Union School District
City of Arcata
City of Blue Lake
City of Eureka
City of Ferndale

Others
Explore North Coast
Friends of Humboldt Bay National Wildlife Refuge
Freshwater Farms
Humboldt County Farm Bureau
Humboldt Baykeeper
North Coast Chapter of the California Native Plant Society
Redwood Region Audubon Society
Sierra Club Redwood Chapter, North Group
Environmental Protection Information Center
Redwood Community Action Agency
Coastal Ecosystems Institute of Northern California
Friends of the Arcata Marsh
Friends of the Dunes
Californians for Alternatives to Toxics
Northcoast Environmental Center
Coast Seafood
Humboldt Bay Oyster Company
Kuiper Mariculture
Aqua-Rodeo Farms
North Bay Shellfish
Pacific Gas and Electric

NOTICE OF PREPARATION FOR THE HUMBOLDT BAY REGIONAL INVASIVE SPARTINA CONTROL AND NATIVE SALT MARSH RESTORATION PROJECT EIR

INTRODUCTION:

The Conservancy is preparing a Programmatic Environmental Impact Report (EIR) to address the potential impacts of the proposed regional program for the control and eradication of non-native *Spartina densiflora.* The EIR is intended to cover all aspects of the project including all necessary permits and approvals from the lead agencies, as well as other local, state, and federal agencies. The EIR and the approved plan can also form the basis for future grant applications to obtain funding necessary to implement certain elements of the overall project. The EIR will be prepared in compliance with the California Environmental Quality Act (CEQA) and the CEQA Guidelines, as amended. The Conservancy will be the lead agency under CEQA. In accordance with CEQA, the lead agency has the responsibility for the scope, content, and legal adequacy of the document. The Draft EIR (DEIR) will incorporate public concerns associated with the Proposed Action and associated project alternatives, and will be sent out for a 45-day public review period, during which time both written and verbal comments will be solicited on the adequacy of the document. The Final EIR will address the comments received on the DEIR during public review. The document will be furnished to all who commented on the DEIR, and made available to anyone that requests a copy during the 45-day public comment period. The draft and final EIR must 1) provide a full and fair discussion of the proposed action's significant environmental impacts, and 2) inform the decisionmakers and the public of reasonable alternatives that would avoid or minimize adverse impacts.

The final step in the review process for the State EIR is certifying the EIR and adopting a Mitigation Monitoring and Reporting Plan. A certified EIR indicates that the environmental document has been completed in compliance with CEQA; that the decision-making body of the lead agency reviewed and considered the FEIR prior to approving the project; and that the FEIR reflects the lead agency's independent judgment and analysis.

SCOPING PROCESS:

Public participation in the environmental scoping process is an important step in determining the full scope of issues to be addressed in the EIR. The Conservancy and the USFWS request your comments on the scope and content of the draft Joint EIR, as outlined in this NOP. Written comments must be provided to Joel Gerwein, California State Coastal Conservancy, 1330 Broadway, 13th Floor, Oakland, CA 94612, e-mail: jgerwein@scc.ca.gov, **no later than February 9, 2011.**

A public scoping hearing will be held on January 19, 2010 at 7:00 p.m. Location : Arcata D Street Neighborhood Center, located on D Street between 13th and 14th St in Arcata.

PROJECT DESCRIPTION:

The project involves the removal of invasive *Spartina densiflora* (*Spartina*) and the restoration of native marsh vegetation to salt and brackish marshes in Humboldt Bay, the Eel River Delta and the Mad River Estuary (Figure 1). Invasive *Spartina* is currently found in an estimated 90% of salt marshes in these three adjacent estuaries at varying densities, and in some areas is spreading on to adjacent mudflats. While mapping of the infestation is currently incomplete, between 1,000 and 1,800 acres of salt and brackish marsh in the three estuaries is infested by invasive *Spartina*. The three estuaries support significant acreage of salt marsh, with approximately 900 acres in Humboldt Bay, 700-900 acres in the Eel River Delta, and <25 acres in the Mad River Estuary. Densities of invasive *Spartina* vary across this area. Some areas contain low-density *Spartina* (<10% cover) intermixed with native species, while other areas support high density *Spartina* (>80% cover) with a low cover of native species such as pickleweed (*Sarcocornia pacifica*). Methods to be employed in *Spartina* removal and control could include the following:

- Mechanical removal with handheld metal-bladed brush cutters,
- Mechanical removal with large tracked equipment (e.g. Amphibious bobcat) or using standard excavators working from levees
- Manual removal with hand tools (e.g. shovels, Pulaskis)
- Mowing to reduce seed set
- Covering/blanketing
- Flooding
- Flaming of seedlings using backpack or machine mounted flame-weeders
- Chemical treatment with herbicide (e.g. imazapyr, glyphosate)

Other control techniques with greater efficacy and similar or lesser impacts may also be used if such methods are developed in the future. As discussed below in the section on Project Need, manual and mechanical control of *Spartina* is underway for lands within the Humboldt Bay National Wildlife Refuge. The EIR will focus on portions of the Project Area outside the HBNWR, although follow up activities within the HBNWR will also be considered in the environmental analysis.

Mechanical treatment with handheld metal brushcutters involves the use of brushcutters to mulch aboveground portions of *Spartina* and to grind up *Spartina* rhizomes in the top few inches of the marsh. One to three return treatments are typically necessary to control resprouts. Mechanical treatment with handheld brush cutters would likely be used in areas of low- to medium-density *Spartina* or in small areas of high density *Spartina*, particularly where sensitive plant species are present and avoidance of impacts to these species is feasible using this method. This method may also be used to remove seedlings. It may also be employed in large areas of high density *Spartina* when/where crew labor is readily available. This technique reduces wrack

to a relatively fine texture (but not as fine as a mechanized flail mower). The resulting debris does not accumulate on the marsh. However, if above ground material is simply mowed rather than mulched, raking and removal of wrack is required.

Mechanical treatment with large tracked equipment would involve the use of an amphibious bobcat with a flail and a rototiller attachment. The flail would cut and mulch aboveground material, while the rototiller would destroy rhizomes in the shallow subsurface soil. The flail may also be deployed below the surface to mulch rhizomes. Debris generated by the flail mower applied to aboveground *Spartina* is ground into very small fragments that are allowed to remain on the marsh surface and be carried by the tides. With the rototiller, most of the wrack remains in place, much of it still attached. Recovery of natives under these circumstances has not been tested. Standard tracked excavators may also be used for mechanical excavation of *Spartina* where populations are accessible from levees or upland areas. Control methods based on large tracked equipment would be most applicable to high density, large patches of *Spartina* in areas where the equipment could be staged (e.g. Eureka Marsh west of Highway 101). This method may also be used to remove large patches of seedlings. Excavated or dredged materials would be disposed of in a suitable upland location.

Manual removal includes using hand-tools such as spades, mattocks, or similar tools to dig up *Spartina* plants, including their roots and rhizomes (a horizontal underground root that sends out shoots from buds). The rhizomes of *Spartina densiflora* are typically located in the top few inches of the substrate, but it may nonetheless be challenging to remove all belowground roots and rhizomes with this method. Re-digging and maintenance would be needed to exhaust rhizome reserves of energy and nutrition, and the population of buds capable of resprouting.

Manual removal may be used in areas with low densities of *Spartina*, particularly when volunteer involvement is feasible and desirable. Manual removal is most effective on isolated seedlings, or clumps, where they are infrequent. Because traversing the marsh and gaining the footing necessary for digging can be challenging in the marsh, this method may be best suited to high elevation marshes. Excavated materials would need to be disposed of in a suitable upland location. Disposal of manually removed materials may also be accomplished with specialized low-ground-pressure equipment (amphibious vehicles), but the number of passes needed to transport materials also increases marsh disturbance.

Manual removal using spades or shovels has been shown to be useful as a late-stage retreatment method, after recovering vegetation has created a nearly closed canopy. In this situation treatment with a brush cutter disturbs and de-vegetates a disproportionately large area compared

to the area being treated, which in turn creates safe sites for new seeds. By using spades and focusing down on juvenile plants in this late stage, fewer openings are created. This method is most efficient when employed during late summer when young, juvenile plants that have been previously missed put up easily detected flowering stalks, or in later winter before native plants have greened up. *Spartina* doesn't go dormant and is easily detected among the dormant and deciduous native species.

Top Mowing with handheld brush cutters or with large tracked equipment may be used to remove seedheads of discrete colonies to reduce seed production. Top mowing is effective at reducing density of *Spartina* and increasing native cover, and so can be used as a temporary measure while a project is phased. However, it must be followed up with other methods to eradicate *Spartina*. Mown vegetation without viable seeds or propagules should be removed from the site. Mowing to reduce seed set would likely be used in medium- to high-density populations which threaten to disperse seeds to sites in the area where *Spartina* has been or is being removed. Because *Spartina* removal will not occur throughout the project area in one season, mowing to reduce seed set may be helpful to reduce the extent of recolonizing *Spartina* in control areas.

Covering and blanketing is a technique that is aimed at exhausting the reserves of energy and nutrition in *Spartina* roots and rhizomes and increasing environmental and disease stress. Covering typically involves stapling opaque geotextile fabric completely over and around a *Spartina* patch. This excludes light essential to photosynthesis (transformation of solar energy to food energy), and "bakes" the covered grass in a tent of high temperature and humidity. This technique may be used for discrete colonies where the geotextile fabric can be fastened to the marsh surface securely with landscape staples for a sufficiently long period of time. High tides, high winds, and tide-transported debris common in tidal marshes often make this difficult or impossible in some situations. This method is more labor- and materials-intensive than mechanical removal, and is unlikely to be used extensively. *Spartina* that is killed with this technique would be left in the marsh to break down naturally. This technique may be used to kill plants that have been removed manually in areas that are not subject to full tidal influence without having to transport them offsite.

Flooding entails constructing temporary dikes or other structures to impound standing water to kill emergent vegetation. *Spartina* is intolerant of permanently flooded conditions (Mateos-Naranjo et al. 2007). Diked flooded salt marshes would eliminate existing standing vegetation, but are readily re-colonized by youthful salt marsh vegetation if the diking is brief. Isolating the treatment area for flooding may be accomplished by deploying temporary dikes or by temporarily closing openings in existing dikes. Temporary constructed dikes need not be large to

accomplish treatment. Water-filled geotextile tubes ("inflatable dams"), analogous with inflatable cofferdams used in aquatic construction/dewatering operations, could be deployed around large colonies of *Spartina* within open marsh plains. Upon completion of treatment, inflatable dams would be removed. *Spartina* that is killed with this technique would be left in the marsh to break down naturally. This method would be used opportunistically where large, high density *Spartina* populations are vulnerable to diking that would not be excessively expensive or logistically difficult. This technique is not expected to be used extensively.

Flaming of seedlings using backpack or machine mounted flame-weeders may be used to control seedlings recolonizing control sites. *Spartina densiflora* has a persistent seed bank, and flushes of seedlings in control sites during the first years after control occur either from the seed bank or from newly-dispersed seeds. *Spartina* control will be phased, and seed may disperse from uncontrolled sites to controlled sites. Seedlings may be killed with a low-intensity flame weeder during the early stage of their development. This treatment is especially efficient when seedlings are occurring at high density on otherwise bare mud. However, it can also be used to target clusters of seedlings occurring among native species. The native species are more resistant and can recover from the mild singeing. This method is only viable when seedlings are new and small, in the size range of several inches.

Chemical treatment could occur via backpack sprayer, or power sprayer from a boat or truck. Applications from backpack sprayers or conventional spray truck entails workers walking through the marsh and applying herbicide directly to target plants, with limited overspray to surrounding plants or water surfaces. Spot application from amphibious tracked vehicles or boats would entail vehicles moving through the marsh or adjacent waterway applying herbicide with hand-held equipment to target vegetation with limited overspray. *Spartina* that is killed with this technique would be left in the marsh to break down naturally.

Imazapyr may be used alone or mixed with glyphosate, following label instructions. An imazapyr/glyphosate mixture has been utilized effectively to control *S. densiflora* in Gray's Harbor, Washington by the Washington State Department of Agriculture (Mikkelsen 2010). Glyphosate would provide a brown-down indicator to allow for more rapid detection of missed or skipped areas. Since imazapyr is such a slow-acting herbicide, it is difficult to know if the entire infestation at a site has been effectively treated until the following spring. Glyphosate treatment results in more noticeable yellowing/browning of the treated plants within two weeks. The use of a brown-down indicator would make any green, untreated plants stand out, and a follow-up spot treatment could be applied to these plants without losing a year of control. In addition to the efficacy of glyphosate as a brown-down indicator, experience utilizing glyphosate/imazapyr mixtures in Washington State and the San Francisco Estuary suggest that

the combination may achieve a higher mortality rate for *Spartina* than either herbicide used alone. Utilizing a glyphosate/imazapyr mixture may also reduce the probability that *Spartina* will develop resistance to imazapyr. Herbicide application would occur when *Spartina* is sufficiently active metabolically to facilitate translocation of the herbicides to all parts of the plant, approximately April-November. It is possible that damage to non-target plants could be minimized by applying herbicides when *Spartina* is metabolically active and other species are dormant or have senesced. This possibility will be explored. Chemical application at a specific site would typically occur once a year. A second follow-up treatment targeting missed plants could occur in the same year.

Chemical treatment may be used in moderate- to high-density *Spartina* areas. Chemical treatment may be particularly suitable for areas that are difficult to access, such as portions of the Eel River Delta, where repeated visits for mechanical treatment would be logistically difficult. Chemical treatment may also be used in areas with sensitive wildlife species that could be disturbed by the repeated visits necessary for mechanical treatment. Chemical treatment would be minimized near residential and commercial areas, and in areas that do not receive regular tidal flushing, where the dilution and photodegradation of imazapyr could be significantly slower (Kegley 2008).

Description of herbicides and additives

Imazapyr. Habitat® or Polaris™ are solutions of 28.7% isopropylamine salt of imazapyr in water, equivalent to 22.6% imazapyr acid equivalents (a.e.) or 2 lbs. acid per gallon, and contain a small amount of an acidifier. Because Habitat® is purportedly the same formulation as Arsenal® and this product contains acetic acid, the acidifier in Habitat® is likely also acetic acid (Leson & Associates 2005.) No information has been found in the published literature on manufacturing impurities associated with imazapyr. Because virtually no chemical synthesis yields a totally pure product, technical grade imazapyr most likely contains some impurities. However, to some extent, concern for impurities in technical grade imazapyr is reduced by the fact that most existing toxicity studies on imazapyr were conducted with the technical grade product and encompass the toxic potential of the impurities (SERA 2004). A generic version of this aquatic imazapyr formulation is now available from NuFarm under the product name Polaris AQ™. Imazapyr inhibits an enzyme in the biosynthesis of the three branched-chain aliphatic amino acids valine, leucine, and isoleucine. Animals do not synthesize branched chain aliphatic amino acids, but obtain them from eating plants and other animals. Therefore, the engineered mechanism for plant toxicity, i.e. the interruption of protein synthesis due to a deficiency of the amino acids valine, leucine, and isoleucine, does not adversely impact to birds, mammals, fish or invertebrates. Any toxicity to animals occurs through different mechanisms. (Entrix 2003, p. 24.)

Caffeine, aspirin and table salt are toxic to animals at lower amounts than imazapyr. At the standard application rate of 1.5%, an average-sized person would have to drink 25 gallons (400 cups) of imazapyr mixture to reach lethal levels. At the highest application rate, an applicator would have to wear a contaminated glove for 50 hours or 2 days to reach a level of concern. Consequently, U.S. EPA and the State of California also place no post-treatment restrictions on recreational use of the adjacent surface waters for swimming or fishing. Imazapyr is relatively slow acting and it takes several weeks for the plants to show effects. Plants cease to grow initially in the roots and later in the aboveground portions. (Cox 1996 in Entrix 2003, p. 24.) On *Spartina*, it takes 4-8 weeks after treatment for effects, i.e. yellow flagging of the leaf margin, to show, and complete plant death can take several months. (Patten 2003.) Imazapyr appears to be less effective for control of *S.densiflora* than for *S. alterniflora*, but can nevertheless result in significant mortality and reduced seed set for *S. densiflora* (Drew Kerr, personal communication).

Glyphosate. Aquamaster® and Rodeo® are aqueous solutions containing 53.8% glyphosate in its isopropylamine salt form or 4 lbs. acid per gallon, and contain no inert ingredients other than water. The primary decomposition product of glyphosate is aminomethylphosphonic acid (AMPA), and the commercial product contains an impurity, 2,4-nitrosoglyphosate (NNG). The potential effects of AMPA and NNG are encompassed by the available toxicity data on glyphosate and glyphosate formulations (SERA 1997). Although it is highly toxic to plants, glyphosate has exceptionally low toxicity to mammals, birds, and fish. Glyphosate inhibits an enzyme (5-enolpyruvylshikimic acid-3-phosphate synthase) needed to synthesize an intermediate product in the biosynthesis of the three aromatic amino acids (tyrosine, tryptophan, and phenylanine). These amino acids are important to the synthesis of proteins that link primary and secondary metabolism. Animals do not synthesize these aromatic amino acids but obtain them by eating plants and other animals. Glyphosate therefore has low toxicity to these receptors (Schuette 1998). In general, glyphosate herbicides are somewhat faster acting than imazapyr herbicides. On *Spartina*, complete brown-down occurs within 7 to 21 days (K. Patten, pers. comm. 2004).

Both imazapyr and glyphosate herbicides are systemic broad-spectrum herbicides that are applied to, and absorbed by, roots and foliage and are rapidly transported via the plant's phloem and xylem to its meristematic tissues or growing regions. (Uptake via roots is irrelevant under estuarine conditions because herbicide applications occur onto shoots and foliage.) Because *Spartina* can spread via rhizomes and tillers, the translocation of the herbicide into the rhizomes and tillers and their ensuing cell death effectively prevents further spreading of the clone once the aboveground portion of the plant has died.

Surfactants and colorant. The herbicides would be mixed with a surfactant to facilitate absorption by *Spartina*. The surfactant to be used would be either lecithin [soy bean] based (Liberate), or a methylated vegetable oil (Competitor). No surfactants containing nonylphenol ethoxylate would be used, because of the potential for endocrine disruption in fish. A harmless, inert colorant would also be used to help indicate which areas have been sprayed. The colorant to be used would likely be Blazon® Spray Pattern Indicator "Blue" ("Blazon® Blue"), which has been used successfully in the San Francisco Estuary control program. Blazon® Blue is a water-soluble non-ionic polymeric colorant. As with most colorant products, the active ingredients are proprietary; the Material Safety Data Sheet ("MSDS") only indicates that it is non-hazardous and non-toxic. The product information sheet reports that the product is non-staining to the skin or clothing. The colorant is typically added at a rate of 3 quarts per 100 gallons of solution, or 16 to 24 ounces per acre sprayed.

Depending on the application method, Habitat® or Polaris™ tank mixes will be applied with varying concentrations at 1 to 1.5 pounds of the active ingredient imazapyr (as acid equivalent) per acre (lb imazapyr a.e. /acre). High-volume handheld sprayers will typically use a spray volume of 100 gallons per acre (gal/acre). Low-volume directed sprayers will use about 20 gal/acre. Application of imazapyr herbicide would follow the guidelines and precautions set forth below.

Imazapyr/Glyphosate Mixtures. According to the product labels for Rodeo®,Aquamaster®, Habitat®, and Polaris™, these products may be combined with other herbicides. Aquamaster® and Habitat® or Polaris™ may be combined for the project in order to achieve certain objectives.

The concentrations and application rates for mixtures of imazapyr, surfactant, and colorant proposed to be used by the Project are shown in Table 1. Table 2 shows the maximum concentrations and application rates of glyphosate, surfactants and colorants to be used in glyphosate/imazapyr mixtures. The exact herbicide solution concentration, the choice of surfactants and colorants, and the determination of application rates will be based on site-specific conditions and will be described in the Site-specific Plans, which will be developed annually as part of the project.

Revegetation, Monitoring, and Phasing of the Project

Native marsh species may be planted in some areas after *Spartina* control is complete to facilitate marsh restoration, but passive revegetation is expected to occur rapidly in most areas.

Spartina control is expected to be phased over several years, with control in Humboldt Bay occurring first, followed by control activities in the other two estuaries. Control activities in each area will be concentrated in the first season of treatment. However, follow-up control for several years is expected to be necessary to remove seedlings germinating from the seed bank and to control individuals missed in the initial treatment or regenerating from vegetative fragments or rhizomes. The project would include baseline data collection to determine the extent and characteristics of *Spartina* populations in portions of the project area, and follow-up monitoring to track the efficacy of *Spartina* control and the rate of native marsh recovery. Control areas would be accessed by boat, by foot from adjacent roads, and by amphibious tracked vehicles designed to minimize impacts to wetlands (e.g. Argo).

It is expected that the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD) will coordinate the control and eradication activities. The Conservancy will provide scientific and permitting support and may fund some of the control and eradication activities. The FWS is expected to provide scientific and logistical support for eradication activities, as well.

PROJECT LOCATION:

Humboldt Bay

Humboldt Bay extends from the tidal marshes of Mad River Slough, McDaniel Slough, Gannon Slough, and Janes Creek on the north to the tidal marshes of Hookton Slough, Salmon Creek, and White Slough in the south, and from the Humboldt Bay North and South Jetties on the west to the tidal marshes of the Elk River, Eureka Slough, Freshwater Slough, Ryan Slough, and Jacoby Creek on the west. The project area within the Humboldt Bay is generally depicted on the map attached as Figure 2.

As California's second largest natural bay and the largest estuary on the Pacific coast between San Francisco Bay and Coos Bay, Oregon, Humboldt Bay is a complex ecosystem and valuable resource for California and the nation because of its natural resources, its aesthetic appeal and recreational opportunities, its ecological services, economic benefits, and its vital transportation links. Visitors and Humboldt County residents alike value Humboldt Bay for its natural and man-made attributes. The biota associated with Humboldt Bay is diverse and ecologically significant at scales ranging from a local focus on fisheries to a participation in hemispheric ecological patterns such as shorebird and waterfowl migration. The Humboldt Bay area hosts over 400 plant species, 300 invertebrate species, 100 fish species, and 260 bird species, including those that rely on the bay as they travel the Pacific Flyway. Recent studies indicate the importance of the Bay in the life cycles of commercially and recreationally important fish species, and the general level of biological vitality in the Bay has been identified as an important aesthetic and quality-of-life variable for both residents and visitors to the area. Bountiful aquatic

organisms support commercial and sport finfishing and shellfishing, and the Bay supports many other water dependent and water-related activities. Humboldt Bay has a significant oyster culture industry, producing about 70% of the oysters grown in California. Portions of the diked former tidelands around the Bay, particularly in the Arcata Bottoms, are utilized for agriculture, primarily livestock grazing for dairy and beef production. Arcata, located on Humboldt Bay's northern section, is home to approximately 16,651 people; Eureka, in the central portion of the Bay, has a population of about 25,866; and Loleta/Table Bluff, in the southern section of the Bay, supports about 750 people.

Significant portions of the Humboldt Bay tidelands and former tidelands are protected as part of the California Department of Fish and Game's Mad River Slough, Fay Slough, and Elk River Wildlife Areas, the US Fish and Wildlife Service Humboldt Bay National Wildlife Refuge, the Bureau of Land Management's South Spit Cooperative Management Area, the City of Eureka's Elk River Wildlife Sanctuary, PALCO Marsh and adjacent marshes, and the City of Arcata's Arcata Marsh and Wildlife Sanctuary During the late-nineteenth and early twentieth centuries, diking and filling reduced Bay salt marshes from an estimated 9,000 acres to only 900 acres today. Bay habitat has been further disturbed by discharges of agricultural and urban runoff, industrial and recreational uses, and colonization by invasive *Spartina*.

Eel River Estuary

The estuarine channel of the Eel River flows into the Pacific Ocean approximately 14 miles south of the town of Eureka in Humboldt County. The project area within the Eel River Estuary is generally depicted on the map attached as Figure 3.

The Eel River Estuary includes approximately 24 square miles of delta lands, wetlands, and estuarine channels that receive runoff from 3,700 square miles of the mountainous Eel River Basin. It is considered one of the most significant estuaries along the entire California Coast, and its mosaic of tidal flats, sloughs, marshes and seasonal wetlands supports hundreds of thousands of resident and migratory waterfowl. Approximately 875 acres of salt marsh are present in the estuary today (Schlosser et al. 2010). Approximately 5,200 additional acres of salt marsh that were present in the estuary in 1855 have been lost due to diking, filling, and other human activities. Invasive dense-flowered *Spartina* has been noted to be widespread in the marshes of the Eel River estuary, but *Spartina* distribution in this area has not yet been mapped. The Eel River was designated as a Critical Coastal Area (CCA) in 1995, as a waterbody impaired by excessive sediment and temperature that flows into an estuary. Located in the Eel River delta are the City of Ferndale, with an estimated population of 1,400, (U.S. Census Bureau 2000), and the unincorporated community of Loleta. Land use in the region includes gravel mining, dairy, timber harvest, and recreation.

Mad River Estuary

The Mad River estuary is located just north of Arcata. The project area within the Mad River Estuary is depicted on the map attached as Figure 4.

Like the Eel River, the Mad River was designated as a CCA in 1995, as a waterbody impaired by excessive sediment, temperature, and turbidity that flows into an estuary. The Mad River estuary is smaller than the Humboldt Bay and Eel River estuaries, and contains a smaller acreage of tidal marsh. It is an extremely dynamic ecosystem, as evidenced by significant migration of the mouth of the Mad River up and down the coast since the 1940s. Between 1942 and 1992, the Mad River mouth moved from a location approximately across from present-day School Road in McKinleyville to just below the Clam Beach Vista Point across from the McKinleyville airport.

The river inlet remained in the vicinity of the vista point until 1998, when storm discharge breached a new inlet approximately 1.5 miles to the south in the vicinity of the 1969 location. The river inlet has gradually migrated northward since 1998, reaching the vicinity of Murray Road in 2008 (Mad River Watershed Assessment 2010). The abandoned channel became a lagoon/estuary with a mixture of freshwater and brackish marshes, fed by Widow White Creek and subject to high tides entering the new mouth of the river. The estuary provides critical nursery habitat for juvenile coho and Chinook salmon and steelhead (Mad River Watershed Assessment 2010). It also supports populations of western snowy plover. Invasive *Spartina* is present in this estuary, in marshes and flood channels, and in and adjacent to riparian scrub habitat. As is the case with the Eel River estuary, the *Spartina* population in the Mad River estuary has not been mapped.

PROJECT NEED:

Invasive *Spartina* is known to displace native vegetation, reducing the biodiversity of the salt marsh dramatically. No native *Spartina* species are found in the Humboldt Bay region. A 1997 U.S. Fish and Wildlife Service (FWS) study reported a dramatic increase in *Spartina* frequency over the previous 10 years in the Mad River Slough Unit of the Humboldt Bay National Wildlife Refuge (HBNWR), supporting the concern that *Spartina* threatens to increase its disruption of the Bay ecosystem. In 1998 and 1999, the FWS undertook mapping and observations of *Spartina* and of two rare high salt marsh plants, Humboldt Bay owl's clover (*Castilleja ambigua* var. *humboldtiensis*) and Point Reyes bird's beak (*Cordylanthus maritimus* ssp. *palustris*). The study looked at all three plants because *Spartina* had been observed to be encroaching upon the same salt marsh elevations at which the two rare plants are found. The FWS' February 2001 report[1] on its findings noted among management implications that the "dense-flowered *Spartina* continues to be a major threat to biological diversity" and that "identifying and applying control

[1] Available at http://www.fws.gov/humboldtbay/*Spartina*.html

measures for this invasive plant is of the highest priority." Mapping of Humboldt Bay salt marsh in 1998 and 1999 indicated that over half of the total salt marsh consisted of nearly pure stands of *Spartina*, and the species was present in much of the remaining salt marsh, as well. The 1998-1999 mapping also showed that, while *Spartina* is most abundant at mid-marsh elevations in Humboldt Bay, it is spreading to the high marsh, where it threatens to displace populations of Humboldt Bay Owl's Clover and Point Reyes Bird's Beak. A recent report on the *Status of Perennial Estuarine Wetlands in the State of California*[2] (Sutula et al. 2008) stated that improving biological conditions in the North Coast region requires controlling invasive *Spartina*, because its increasing dominance will decrease the structural complexity and species richness of estuarine wetlands.

While *Spartina* is most common in Humboldt Bay in salt and brackish marshes, its presence has also been increasingly noted on mudflats and on sand spits, and it has the potential to spread in these environments. Studies have been initiated to identify ecosystem-level impacts of this invasion, including effects on net ecosystem primary productivity and possible shifts in trophic foodwebs. As a tall, dense graminoid invading a native, more open mat-like plant community, Spartina may alter light penetration, causing shifts from autotropohic to heterotrophic food webs. Preliminary studies at Humboldt Bay point toward the likelihood that Spartina invasion reduces the diversity and abundance of terrestrial invertebrates. It may also alter sedimentation rates in Humboldt Bay and neighboring estuaries. In other estuaries, the invasive members of the genus have been shown to act as "ecosystem engineers," bringing about drastic changes to ecosystem functions. In addition to its direct impacts, the dominance of invasive *Spartina* in Humboldt Bay has slowed efforts at marsh restoration because of fears that restored marshes will become dominated by *Spartina*, compromising their habitat value. In addition to its impacts locally to these estuaries, *Spartina* in Humboldt Bay and adjacent estuaries threatens to colonize other west coast estuaries via ocean dispersal of its seeds, as demonstrated by the preliminary results of a drift card study carried out by Portland State University. Drift cards from Humboldt Bay in 2004 and 2005 were found within a month of their release in numerous locations along the Oregon Coast, as well as in southwest Washington. The 2007 West Coast Governors' Agreement on Ocean Health Action Plan[3] calls for the west coast-wide eradication of invasive *Spartina* by the year 2018.

Work in several west coast estuaries including San Francisco Bay, California and Willapa Bay, Washington, has shown that a prerequisite to successful eradication of invasive *Spartina* is a coordinated, regional approach. Since the species disperses primarily by seed, it is necessary to greatly reduce seed production within the control area and any source populations. Eradication

[2] Available at www.sccwrp.org
[3] Available at http://westcoastoceans.gov/

can then be achieved once the seed bank is exhausted. Experiences in other west coast estuaries have shown that the local community must be educated and supportive for such an eradication program to succeed. This is especially true when some salt marshes are under private ownership, as is the case in Humboldt Bay and adjacent estuaries.

In San Francisco Bay and in Washington and Oregon, successful eradication has involved the use of the herbicide imazapyr as part of an Integrated Pest Management strategy that also includes mechanical methods. It should be noted, however, that the San Francisco Bay and Willapa Bay (Washington) invasions consist primarily of *Spartina alterniflora*. Imazapyr has not proven to be as effective on *S. densiflora* in San Francisco Bay as it has on *S .alterniflora*, although a combination of herbicide treatment following mechanical methods has proven to be effective.

The FWS staff at the HBNWR has been working for over four years cooperatively with the Conservancy to develop mechanical *Spartina* control techniques. Pilot control efforts between 2002 and 2009 resulted in the eradication of virtually all mature *Spartina* in a 35-acre treatment area adjacent to the Mad River Slough. This work has shown that mechanical methods can be used successfully at this scale, and over a larger area as part of an IPM strategy. It has also demonstrated the need for an aggressive, regional approach to successfully eradicate *S. densiflora* relatively quickly in order to prevent re-invasion in Humboldt Bay and its spread to other locations along the west coast. In 2010, the HBNWR initiated an effort to remove *Spartina* from 300 acres of refuge lands in Humboldt Bay using mechanical methods. This effort has relied on the use of handheld brushcutters in 2010, and may employ large tracked equipment in 2011.

PURPOSE:
The goal of the Project is to control and where possible eliminate invasive *Spartina densiflora*, in order to restore the native communities of tidal marshlands in the Humboldt Bay region and to minimize the threat of invasive *Spartina* dispersal to estuaries outside the project area.

POTENTIAL DISCRETIONARY ACTIONS AND APPROVALS:

The following actions and approvals may be required:

- U. S. Army Corps of Engineers 404 and Section 10 permits of the Rivers and Harbor Act and Section 404 of the Federal Clean Water Act;
- Federal and State Endangered Species Act Consultations;
- California State Coastal Conservancy Plan approval;

- California Department of Transportation (Caltrans) Encroachment Permit(s);
- California Department of Fish and Game Streambed Alteration Agreements(s), Section 1601 of the DFG code;
- North Coast Regional Water Quality Control Board 401 Certification and/or Discharge Permit(s);
- North Coast Unified Air Quality Management District Permit(s);
- Humboldt Bay Harbor, Recreation, and Conservation District permit(s);
- North Coast Railroad Authority Encroachment Permit(s);
- State and Local agency approval of specific implementation of projects(s);

Responsible, cooperating, and trustee agencies are requested to review and refine this list of required actions and approvals.

CONTENT OF THE EIR:
The EIR will analyze, describe, and evaluate all potential environmental impacts of the range of alternatives presented in the document. Individual and cumulative impacts of two alternatives, as well as the no project/no action alternative, in accordance with CEQA will be evaluated. Alternative 1 would involve selecting from all control methods listed above under "Project Description" to control *Spartina* in the project area. Alternative 2 is the same as Alternative 1, but would not involve the use of herbicides. The range of alternatives being considered may be refined, revised, or expanded as a result of the scoping process. A variety of potential methods for controlling invasive *Spartina* will be presented along with the potential environmental impacts for each method and for the control program as a whole.

EIR FORMAT
The EIR will be prepared in accordance with the Environmental Impact Statement (EIS) Format specified in the CEQA Regulations, Part 1502 and Table 2 of Supplementary Document T of the CEQA Guidelines. Preparing the EIR in EIS format will facilitate future adoption of the document for National Environmental Policy Act (NEPA) compliance purposes. Compliance with NEPA may be required by federal agencies issuing permits or providing funding for the Project. Minor changes to this format may be required to fully comply with the guidelines for implementing NEPA, as developed by the federal agency involved.

ISSUE ANALYSIS (ENVIRONMENTAL CONSEQUENCES)
For each issue listed below, the EIR will include a discussion of the parameters used in evaluating impacts; potential impacts from the various alternatives; recommended mitigation, indicating the effectiveness of mitigation measures proposed to be implemented and what, if any, additional measures would be required to reduce the impacts to below a level of significance. Impact analysis will include a discussion of direct and indirect impacts, short- and long-term impacts, cumulative impacts, and unavoidable impacts. In addition, the impact discussion will also identify any areas of known controversy. Finally, the EIR will identify any unavoidable adverse impacts that would result from project implementation. The list of issues presented below is preliminary both in scope and number. Additional issues may be identified during the scoping process.

a. *Water Quality*
The EIR will:

Describe existing water quality conditions in the Project Area, with emphasis on marsh habitat.

Address direct impacts to water quality from each of the project alternatives (i.e., proposed methods for treating *Spartina*), as well as indirect effects due to the project. Where impacts to water quality are considered significant, possible mitigation measures that potentially can reduce the level of impact to less than significant will be evaluated and described.

Consider erosion of marsh sediments and remobilization of buried sediment contaminants; bank erosion due to *Spartina* removal along tidal channels, accumulation of organic detritus from physical/mechanical control approaches in tidal channels, with potentials for inducing stagnation and causing reductions in dissolved oxygen levels and/or increased turbidity and suspended solids; and other impacts described by previous programs for controlling invasive plant species. Water quality impacts from project-related erosion will be evaluated in the context of Project Area fine sediment loads and sediment budgets.

b. *Biological Resources*
The EIR will:

Identify potential sensitive species and habitats in or near the potential *Spartina* control project areas based on site visits, data review, and CNDDB data search.

Determine the abundance and distribution of sensitive species and the extent of sensitive habitats (including buffer zone areas) that may be impacted by *Spartina* control efforts at priority sites and pilot project sites. Specific species to be addressed include Humboldt Bay owl's clover (*Castilleja ambigua* ssp. *humboldtiensis*), Point Reyes bird's beak (*Cordylanthus maritimus* ssp. *palustris*), Lyngbye's sedge (*Carex lyngbyeii*), tidewater goby (*Eucycloglobius newberryi*), coho salmon (*Oncorhyncus kisutch*), Chinook salmon (*O. tshawytscha*), steelhead trout (*O.mykiss*), and special status bird species, such as Northern harrier (*Circus cyaneus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and snowy egret (*Egretta thula*). Other sensitive species identified in consultation with CDFG and the USFWS also will be addressed.

Identify and analyze temporary and permanent, direct and indirect project and cumulative impacts to sensitive species and sensitive habitats of *Spartina* control methods listed in the project description above. These methods will be analyzed in the context of their potential to cause the spread of *Spartina*, introduce toxics into the food chain via application of herbicides, and impact sensitive species and habitats. Direct and indirect impacts that will be analyzed include trampling and other habitat degradation, disturbance to wildlife, biodiversity, modification of tidal drainage patterns, loss of cover, and other physical/chemical processes that may disturb sensitive species or habitats. The analysis will include an evaluation of the efficacy of individual and a combination of control methods as well as any other feasible methods (e.g., revegetation with natives following treatment) that would control *Spartina* and restore native marsh communities in the Project Area. The focus of the analysis and field study will be in tidal marshlands along the margin of Humboldt Bay, the Eel River Delta, and the Mad River Estuary.

As noted above, analysis of Humboldt Bay marshlands will focus on areas outside the Humboldt Bay National Wildlife Refuge (HBNWR), because *Spartina* control within HBNWR is already in process and has undergone environmental impact analysis by the USFWS to comply with NEPA. For all identified impacts, feasible mitigation measures will be developed with the goal of reducing significant or potentially significant impacts to an insignificant level.

c. *Hazards and Hazardous Materials*
The EIR will:

Address the direct and indirect environmental health hazards to humans from implementation of the chemical applications and use of other hazardous materials, such as fuel for gasoline-powered control equipment, proposed in the *Spartina* program.

d. *Aesthetics*
The EIR will:

Analyze visual resources based on site reconnaissance and review of ground level and aerial photographs, topographic maps, GIS and other pertinent data.

Document the existing visual character of the marsh and identify the representative visual conditions within the overall study area. Representative land and water views accessible to the public will be documented as part of the visual baseline.

The project visual setting will be described in terms of the local and regional landscape context. It will include a description of the overall project viewshed in terms of topography, vegetation, land, water and built form that can be seen by the public. Baseline visual conditions will be described including representative photographs. Public use areas such as the shoreline, the highways, and recreational and residential areas also will be documented.

Visual impacts will focus on the foreseeable visual changes associated with the Project and their effects on baseline visual resource conditions. Changes in vegetative cover, changes in color and texture and changes in level of visual screening associated with both the programmatic and site specific aspects of the Project will be described. Seasonal change effects also will also be considered.

e. *Land Use*
The EIR will:

Describe and map existing land uses, land use designations, and zoning district boundaries at a programmatic level for the project area and include narrative evaluation supported by photographs and graphics.

Applicable zoning and general plan designations and policies will be identified and summarized. Potential conflicts associated with the proposed program and existing planning and zoning designations will be evaluated.

Conflicts with surrounding or nearby land uses will be determined generally for the overall program area, and specifically for the priority sites. Appropriate measures to mitigate any identified adverse land use impacts will be identified.

f. *Air Quality*
The EIR will:

Analyze changes to air quality caused by the proposed *Spartina* control measures that would most affect air quality, e.g., the use of gas-powered brushcutters, chemical control using herbicides or surfactants, burning *Spartina* wrack, or flaming seedlings. The analysis will be conducted in accordance with procedures recommended by the North Coast Unified Air Quality Management District (NCUAQMD). The NCUAQMD will be consulted regarding the appropriate significance thresholds for short-term eradication/control measures.

Describe physical and regulatory air quality for the affected area (i.e., the Humboldt Bay coastal region), based on air quality data at the two closest air monitoring stations. Applicable air quality regulations, significance thresholds and planning efforts will be described for the Humboldt Bay Area. All of Humboldt County has been designated by the California State Air Quality Board as being in "non-attainment" for PM-10 air emissions, and the evaluation will consider impacts to air quality from PM-10 air emissions. Specific federal, state and NCUAQMD rules and policies that pertain to agricultural burning and the application of herbicides will be identified. NCUAQMD CEQA guidelines will be consulted for this analysis. Air quality impacts will be assessed by describing the potential "worst-case" dispersion of pollutants. The scenario that could most affect local air quality would be widespread pile burning of *Spartina* wrack. Emissions from pile burns will be described, since the NCUAQMD has rules that address these types of emissions. It is assumed that controlled burns would be limited to designated "Burn Days" that are intended to limit the effects of air pollutants from these activities. If necessary, emissions associated with widespread applications will be modeled using the appropriate screening model approved by the US EPA and BAAQMD.

Assess regional emissions through prediction of the air quality burden associated with the project. This will include predicted changes in air pollutant emissions associated with the project. Predicted changes in air pollutant emissions will be tabulated for each project alternative.

g. *Noise*
The EIR will:

Characterize existing noise levels in the various portions of the Project Area based on existing data and/or spot noise readings. Noise levels generated by equipment used as part of various *Spartina* eradication techniques will be estimated and projected out to sensitive receptor locations. Project-generated noise will be compared to ambient noise levels and to appropriate local General Plan Noise Element and Noise Ordinance standards.

h. *Geology and Soils*
The EIR will:

Evaluate potential impacts from project-related erosion. The project may result in temporary increases in erosion from marshes over a one to two year period during which vegetation will be greatly reduced by control activities. This effect will be mitigated by the *Spartina* mulch that will be left on the marsh surface after mechanical control activities. The project may also result in bank erosion in tidal channels due to the removal of Spartina which may be stabilizing channel banks. These impacts would be reduced to the extent that herbicide treatment is used and dead vegetation is left in place during the period of native marsh plant colonization. The magnitude of these impacts is reduced by the phased nature of the project; *Spartina* control will not occur throughout the project area in a given year. The EIR will analyze this impact to determine its level of significance.

i.*Cultural Resources*
The EIR will:

Evaluate potential project impacts on cultural resources due to shallow ground disturbance from mechanical control. Some marsh areas currently dominated by *Spartina* are likely to contain culturally significant resources that could be disturbed by control activities. Based on a preliminary consultation with the Wiyot Tribe's environmental services director, this impact could be mitigated by training control workers to recognize culturally significant resources. If such resources are uncovered during control activities, work would be halted while a tribal representative was consulted to determine how best to protect the resource in question. The EIR will evaluate the potential significance of this impact.

j. *Greenhouse Gas Emissions*
The EIR will:

Evaluate potential project impacts on greenhouse gas emissions and carbon sequestration. *Spartina densiflora* can fix a large amount of carbon, and past research suggested that it may fix more carbon on an annual per-acre basis than native marsh species such as saltgrass (*Distichlis spicata*). However, these calculations do not account for community changes that are likely to affect net primary productivity. For example, recent studies of San Francisco Bay suggested that invasive *Spartina alterniflora* alters community composition in mudflats and in native marshes, resulting in a reduction in sediment microalgal primary productivity and microalgal Chlorophyll *a* net primary productivity in invasive *Spartina*-dominated marshes compared to mudflats and native *Spartina*- or pickleweed-dominated marshes (Tyler and Grosholz, *in press*). In light of the conflicting and incomplete data available, it is not currently feasible to assess the impact of restoring native marsh species on marsh carbon fixation rates.

Some amount of GHG emissions would result from control activities. Emissions would result from the operation of handheld brushcutters or large tracked vehicles for mechanical control, and from the use of vehicles to access control sites for all control methods. While *Spartina* would typically be left as mulch or dead intact plants on the marsh, in some instances, such as with manual removal, vehicles may be used to haul removed *Spartina* to composting or other disposal sites. However, these activities would be temporary, with a relatively low number of machines

operating for a period of several years. The amount of greenhouse gases generated by these activities would be expected to be less than significant, but this needs to be evaluated through a detailed analysis of potential emissions.

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Tyler, A.C. and E.D. Grosholz. 2010. *Spartina* Invasion Changes Intertidal Ecosystem Metabolism in San Francisco Bay. *In press.*

Table 1: Imazapyr herbicide mixture component concentrations and application rates for treatment of non-native *Spartina densiflora* in Humboldt Bay Region

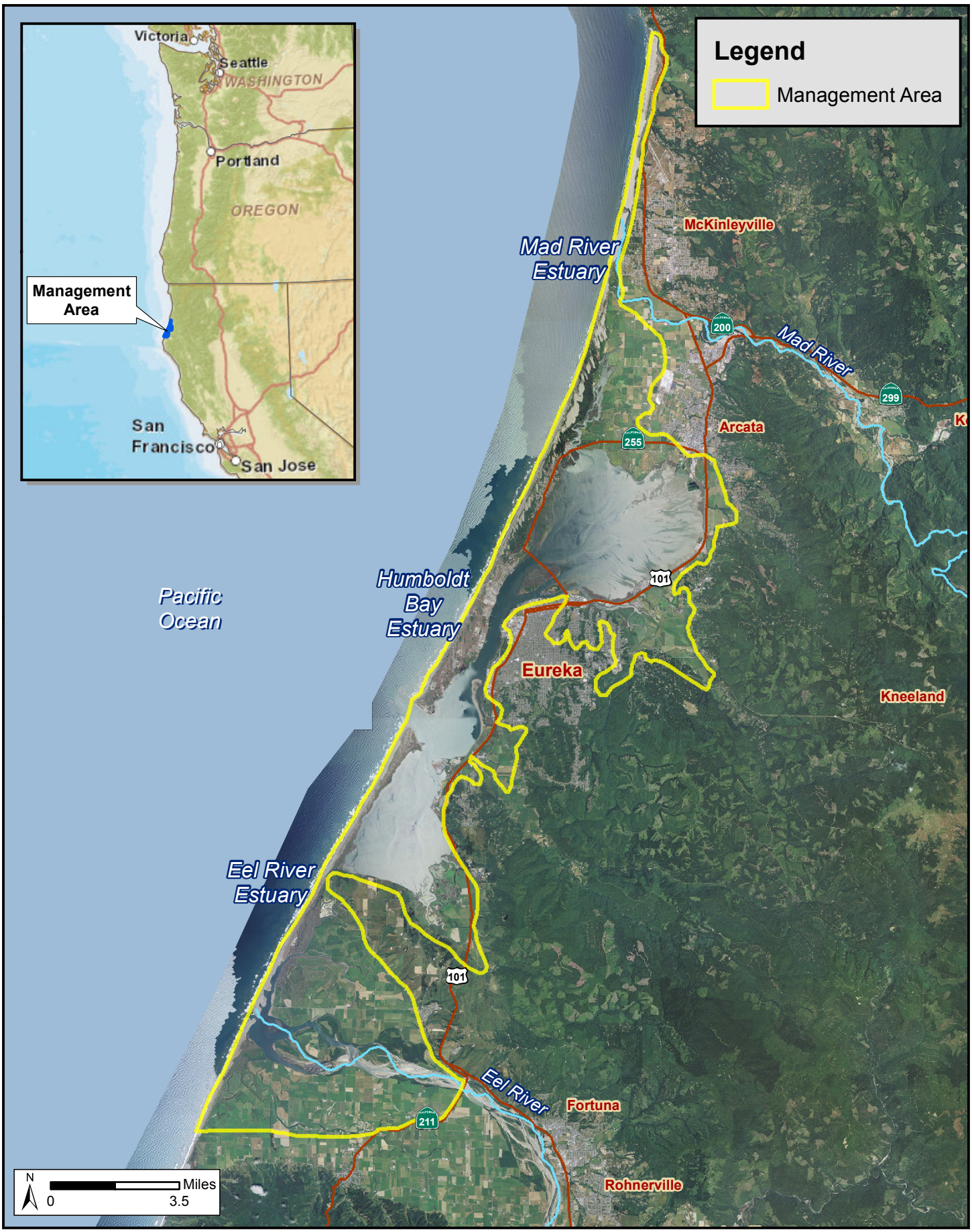
Application Method	Spray Volume	Habitat® or Polaris®	Active Ingredient Imazapyr*	Surfactant**	Colorant
High volume hand-held sprayer (boat or truck application)	100 gal/acre	0.52-0.75% solution 4-6 pints/100 gal	1-1.5 lb a.e./acre	1 qt/100 gal NIS with ≥70% a.i.; ~1% MSO or VOC	3 qt/100 gal
Low-volume directed sprayer (backpack application)	20 gal/acre	0.75-1. 5% solution 1.2-2.4 pints/20 gal	0.3-0.6 lb a.e./acre	1 qt/100 gal NIS with ≥70% a.i.; ~1% MSO or VOC	3 qt/100 gal

* Active ingredient in Habitat® and Polaris® is imazapyr isopropylamine salt; values expressed as imazapyr acid equivalent (a.e.) ** a.i. = active ingredient; NIS = non-ionic surfactant; MSO = methylated seed oil; VOC = vegetable oil concentrate, SBS = silicone-based surfactant

Table 2: Glyphosate herbicide mixture component concentrations and application rates for treatment of non-native *Spartina densiflora* in Humboldt Bay Region

Application Method	Spray Volume	Aquamaster® or Rodeo®	Active Ingredient Glyphosate*	Surfactant**	Colorant
High volume hand-held sprayer (boat or truck application)	100 gal/acre	1-2% solution 1-2 gal/100 gal	4-8 lb a.e./acre	≥2 qt/100 gal NIS with ≥50% a.i.	3 qt/100 gal
Low-volume directed sprayer (backpack application)	25-200 gal/acre	1-8% solution 1-8 gal/100 gal	1.35-10.8 lb a.e./acre	≥2 qt/100 gal NIS with ≥50% a.i.	3 qt/100 gal

* The active ingredient in Rodeo® and Aquamaster® is glyphosate isopropylamine salt; values are expressed as glyphosate acid equivalent (a.e.)
** a.i. = active ingredient; NIS = non-ionic surfactant



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H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 1: Vicinity Map

Humboldt Bay Regional Invasive Spartina Management Plan (3192-01)
December 2010

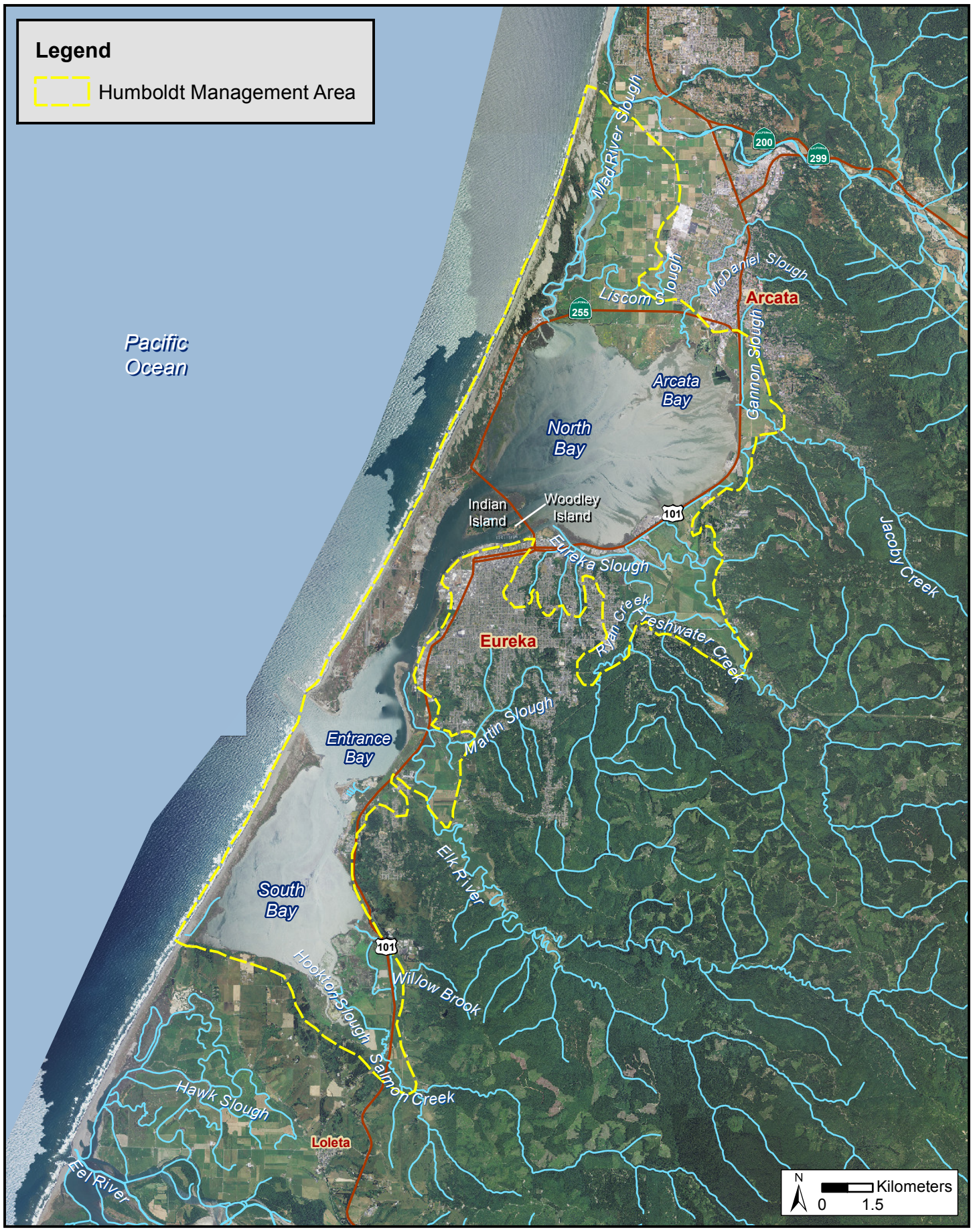

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Figure 2: Humboldt Management Area

Humboldt Bay Regional Invasive Spartina Management Plan (3192-01)
December 2010

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Figure 3: Eel River Management Area

Humboldt Bay Regional Invasive Spartina Management Plan (3192-01)
December 2010

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Figure 4: Mad River Management Area

Humboldt Bay Regional Invasive Spartina Management Plan (3192-01)
December 2010